



Considerations in Designing Statewide Programs to Monitor the Effects of Oil and Gas Development on Groundwater Resources

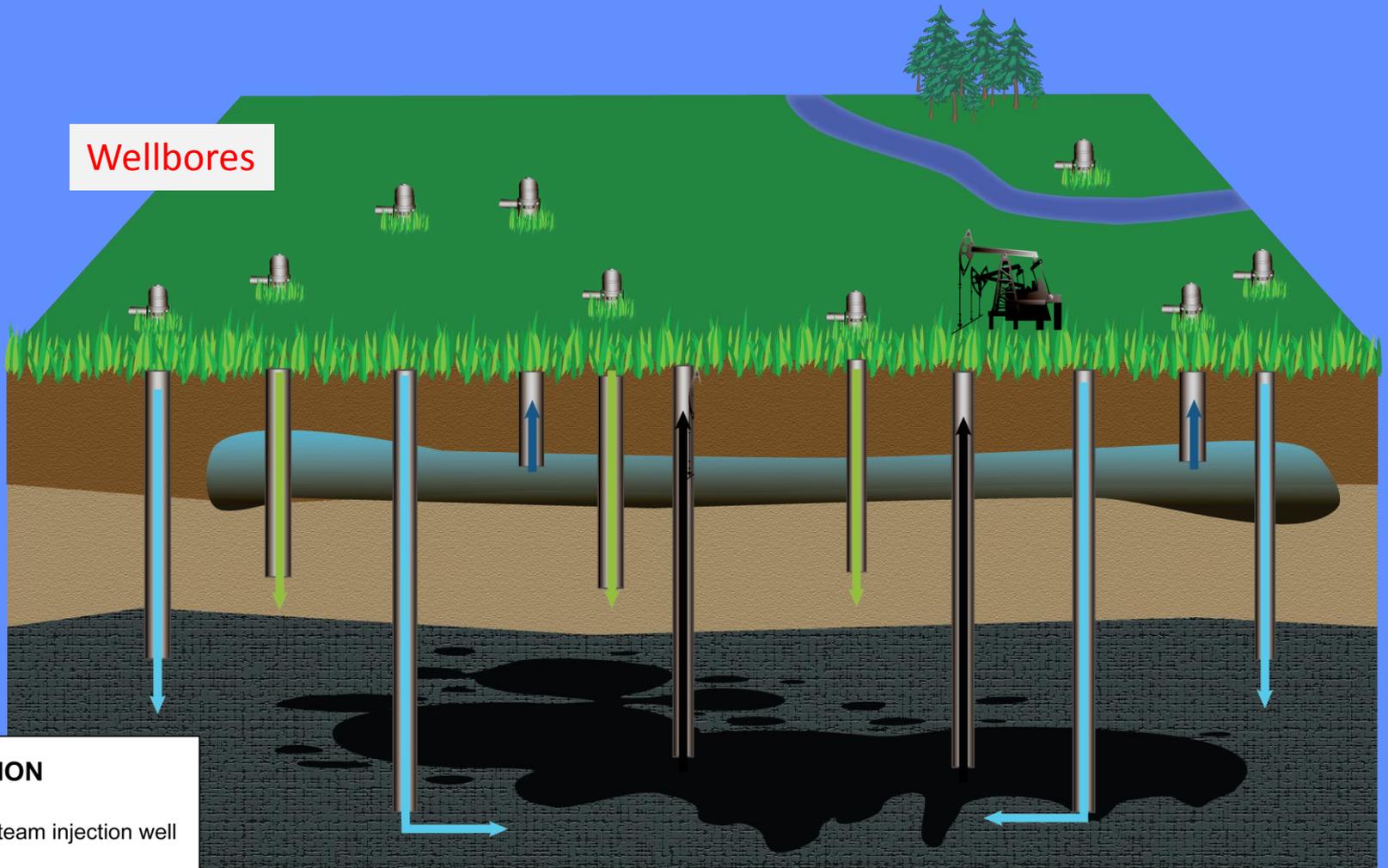
Kim Taylor, USGS California Water Science Center

Four Core Concepts

- Legacy effects
- Vulnerability
- Proximity as first approximation of vulnerability
- Complexity

Factors that Determine Vulnerability

Wellbores



EXPLANATION

-  Water / steam injection well
-  Water supply well
-  Waste-water injection well
-  Oil and gas extraction

Factors that Determine Vulnerability

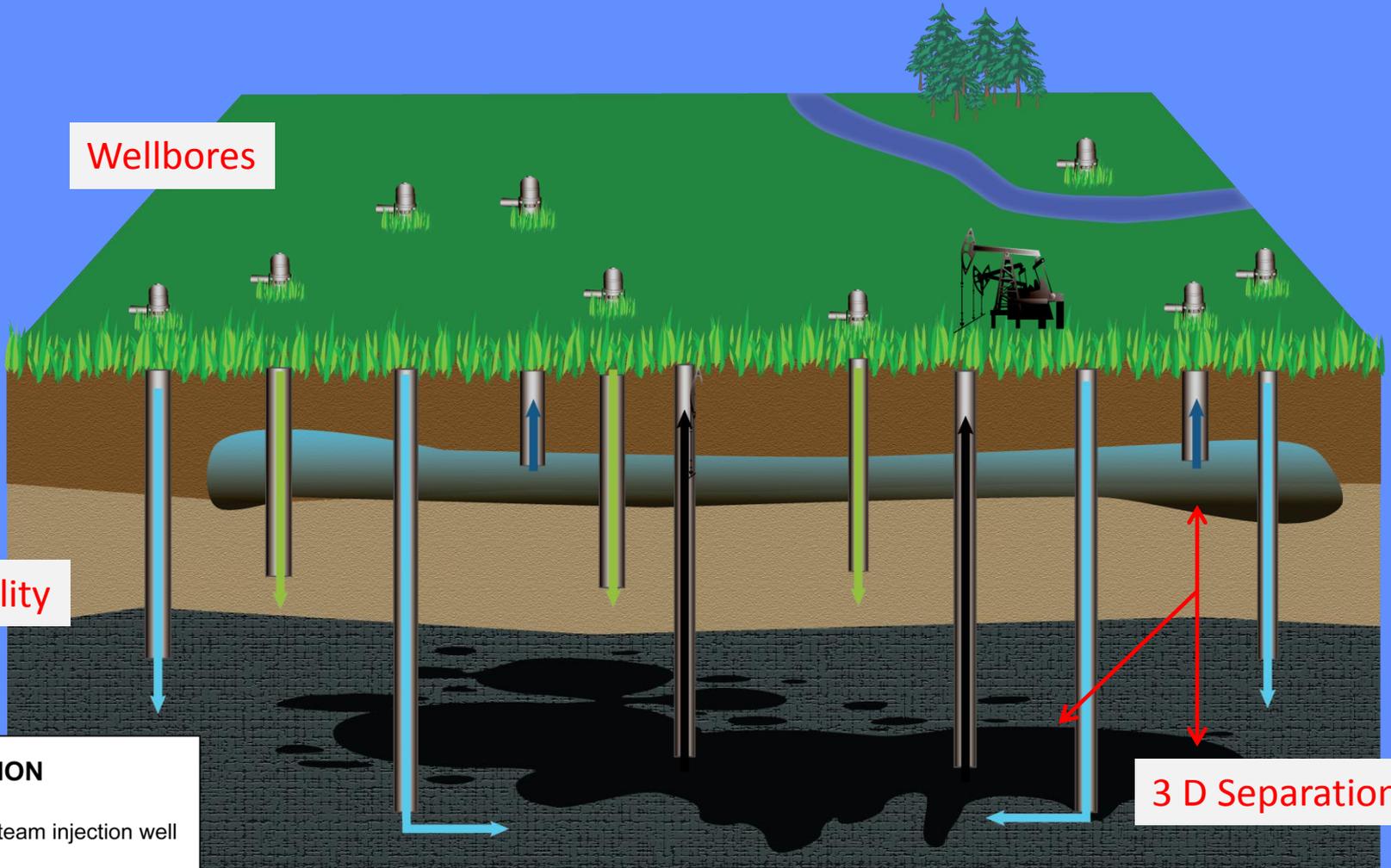
Wellbores

Permeability

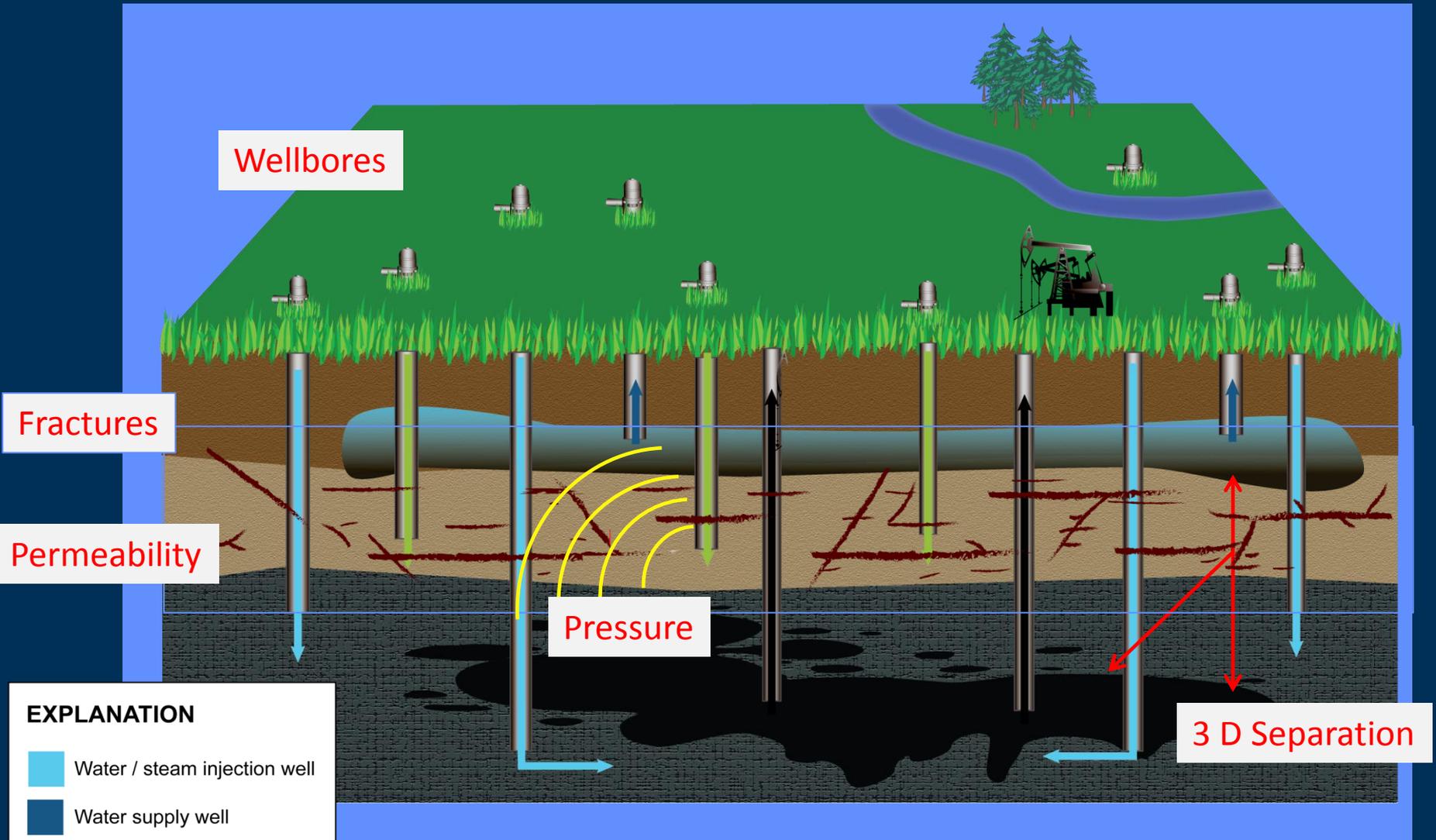
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3 D Separation



Factors that Determine Vulnerability



EXPLANATION

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3 D Separation

Overlap of Locations of Oil and Gas Wells and Drinking Water Wells

Oil and Gas Wells in California

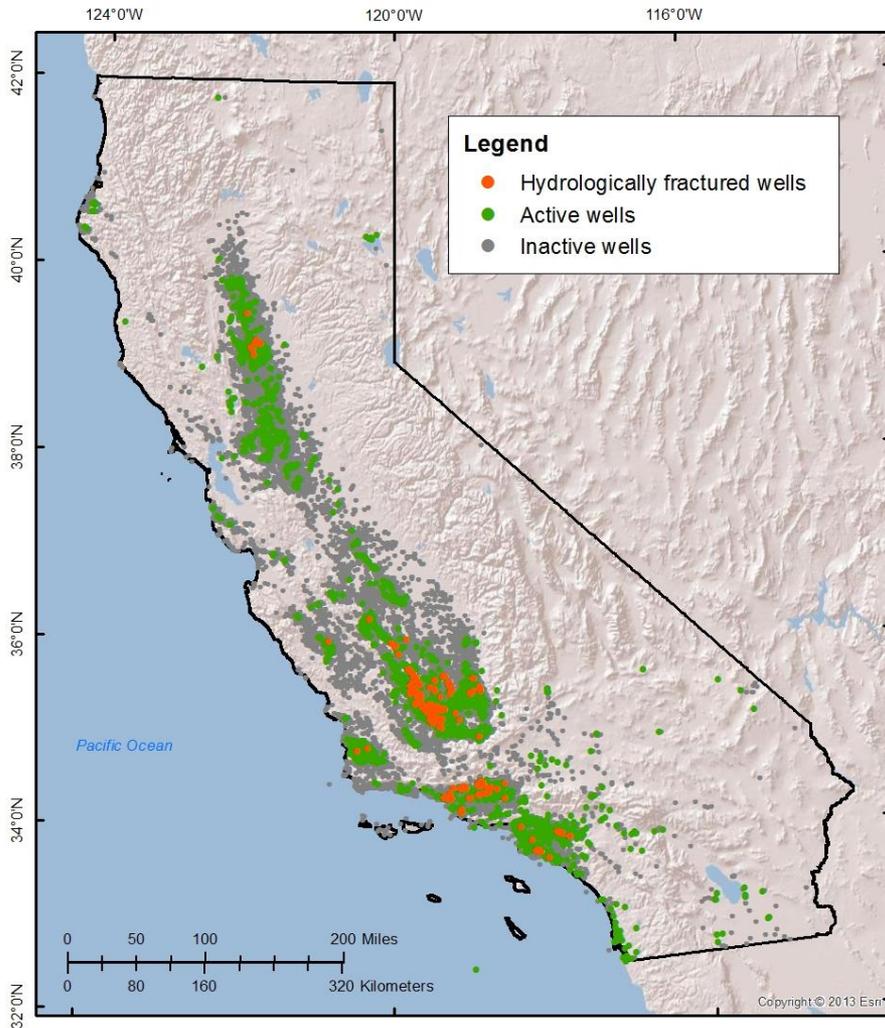


Figure 1a.

Drinking Water Supply Wells in California

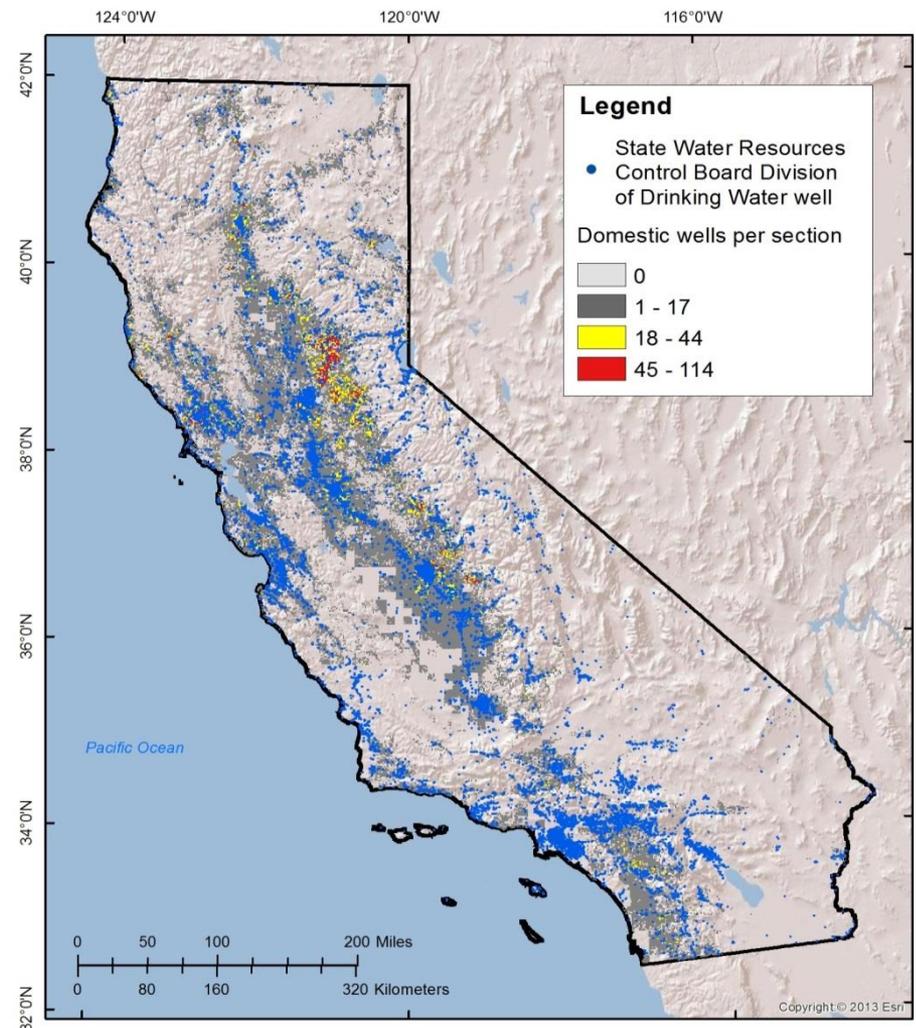
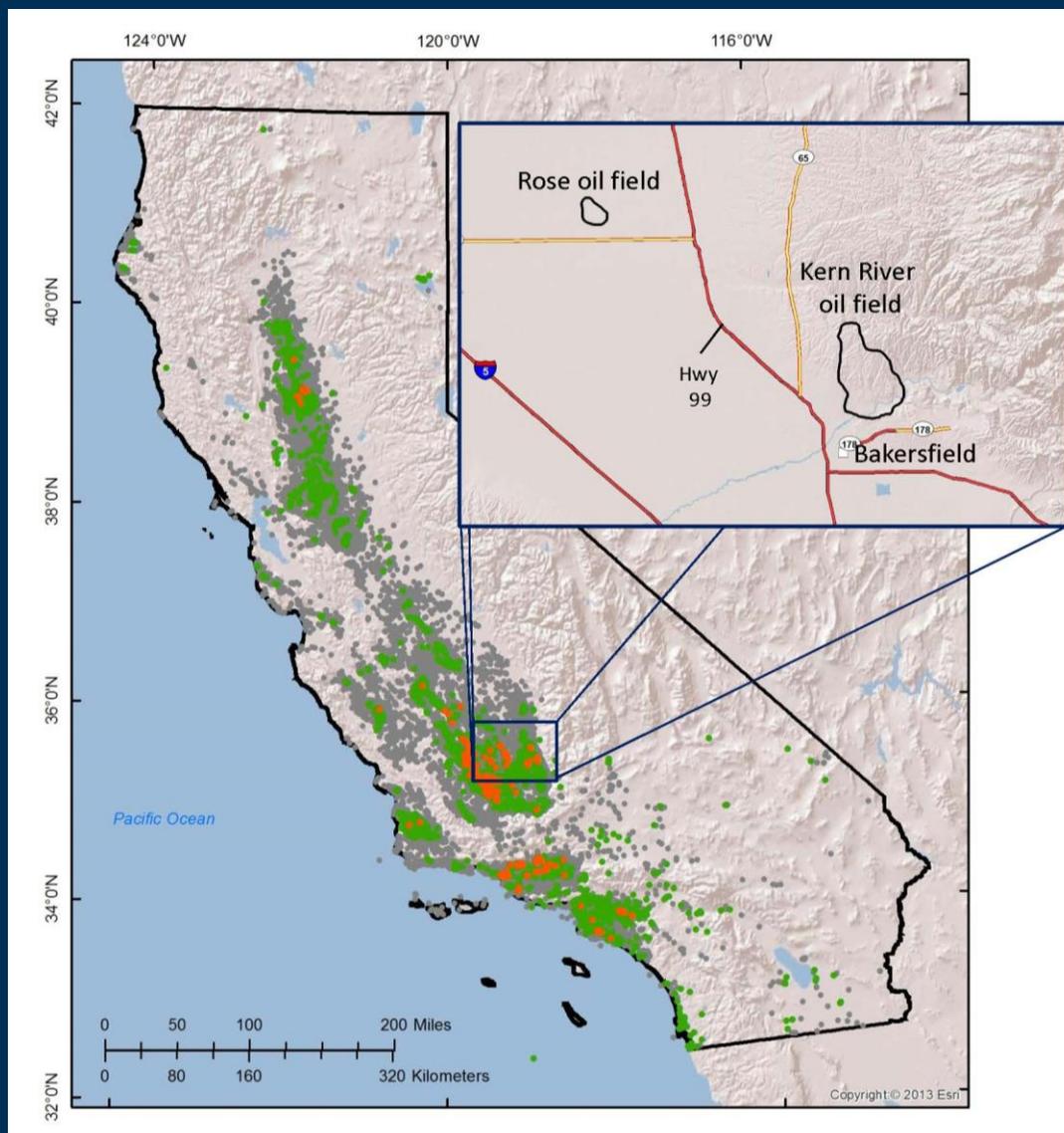
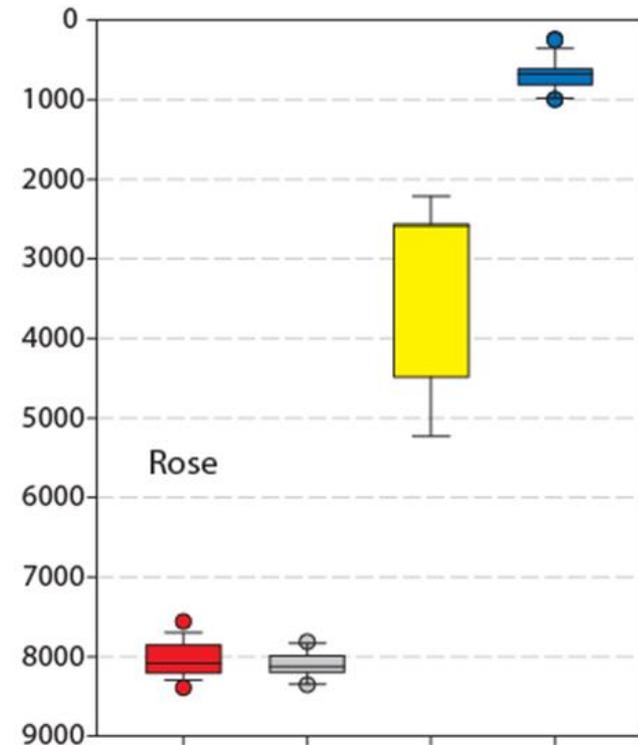
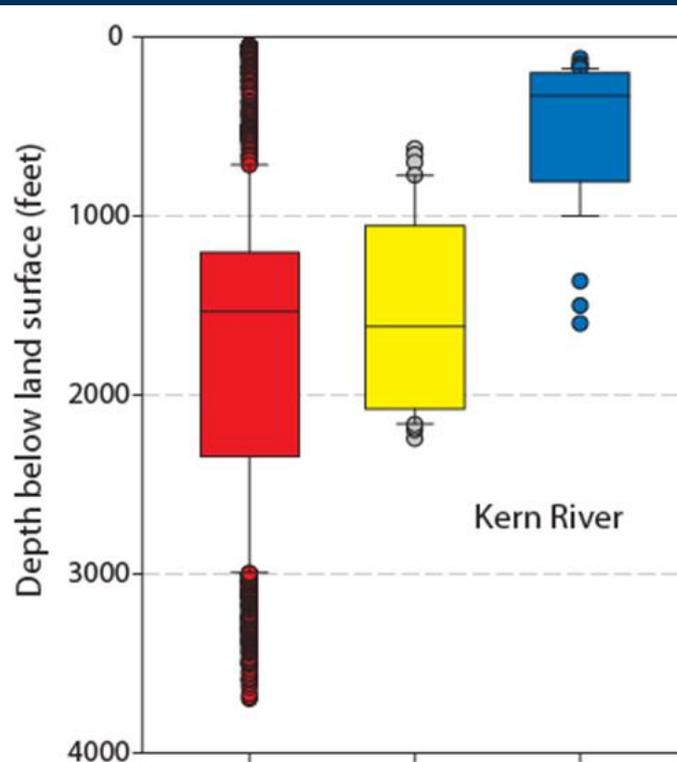


Figure 1b.

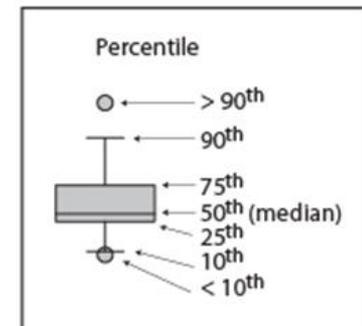
Proximity Example: Kern River and Rose Oil Fields



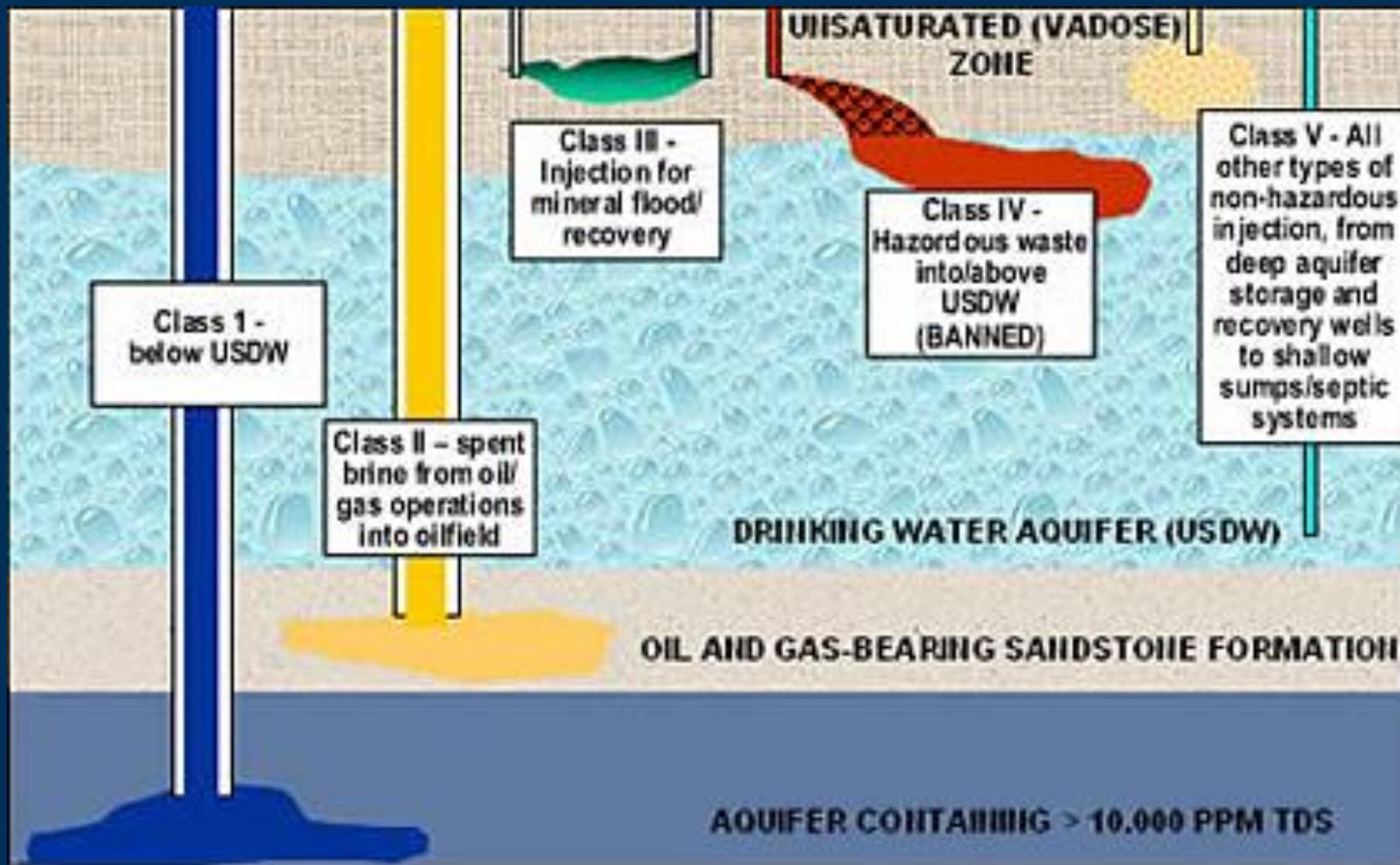
Proximity Example: Kern River and Rose Oil Fields



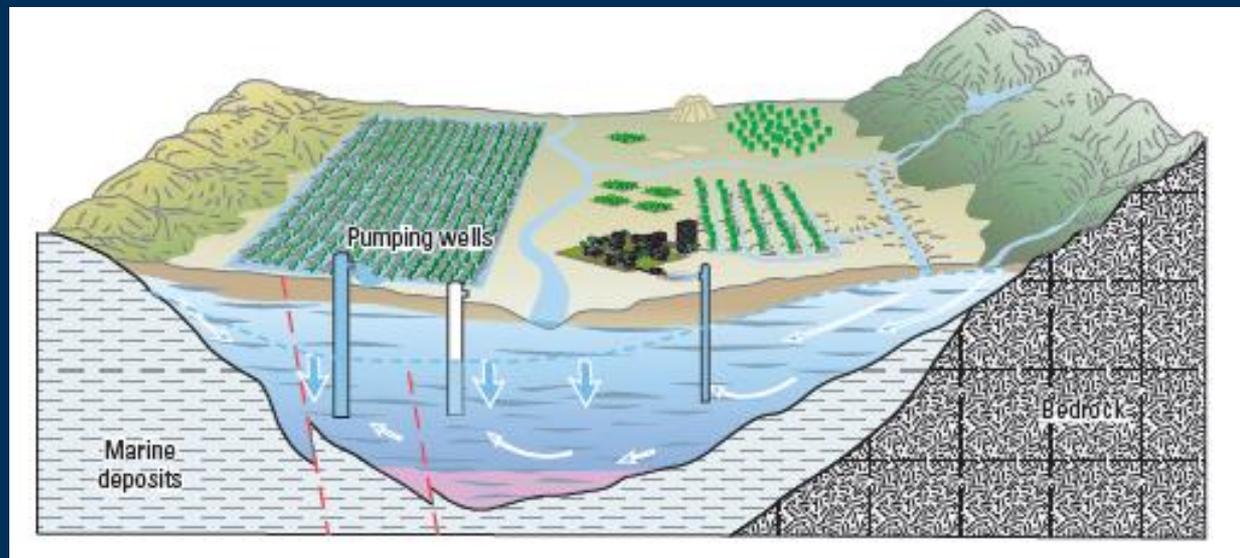
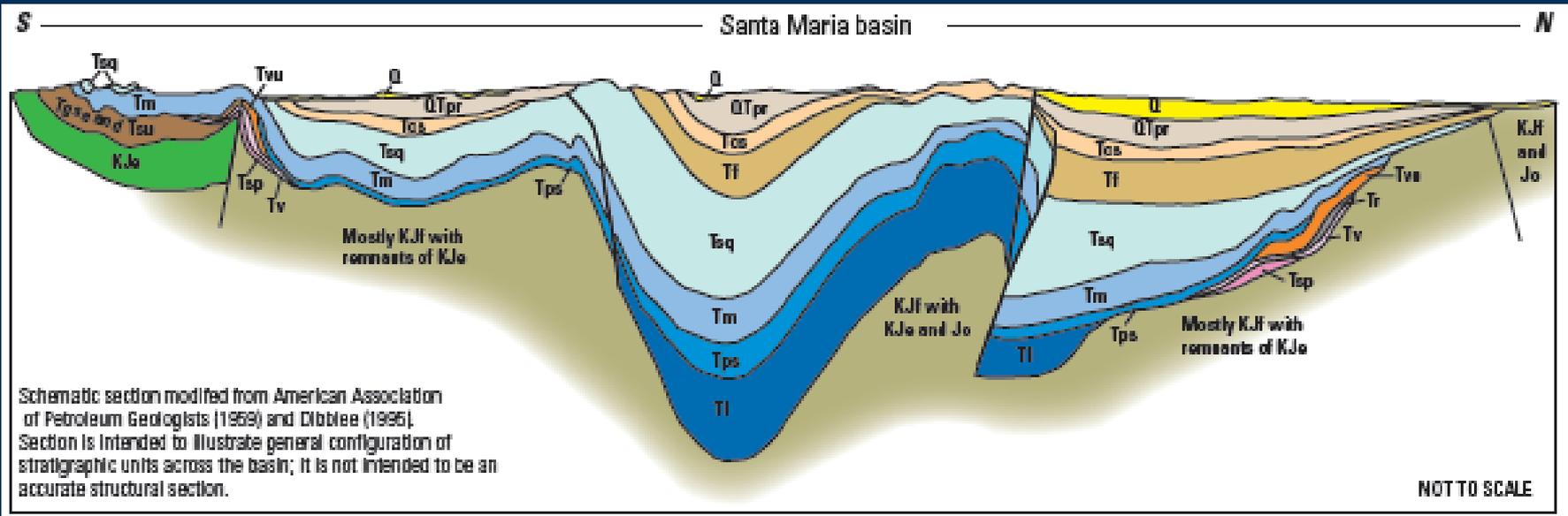
-  Depth of oil & gas extraction wells
-  Top of screen in waste disposal wells
-  Hydraulic fracturing horizon (Rose)
-  Depth of domestic, irrigation, and municipal wells within approximately 1 mile of a waste disposal or hydraulic fracturing well



Complexity



Examples of Complexity



Complexity

